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Research on Learning Effectiveness of Learner-oriented Teaching Strategies Used on the Subject of "Interior Wiring Practice"

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Abstract

Interior wiring work is a practical skill as well as a part of power system configuration planning which apply to housing, factory, business building and even theme park…etc. besides that it is also a certain pre-service training for electrical technicians. However, it is not easy to learn practical skill at school because the traditional learning environment is based on teacher-centered, mostly teachers do not focus on students' individual learning difference and specific proficiency level who provide theory explanation in either implicit or explicit ways but less practice demonstration in lectures. In this situation, students do not have enough input to acquire background knowledge and experience of specific professional to do practices hence they may have gaps between theory and practice. The present study aimed to investigate the effects of two types of instruction on the vocational high school students' learning performance of interior wiring work. Specifically, it was designed to test whether leaner-centered instruction and traditional instruction had any effects on these students' learning performance. The participants were 36 students in one class from electrical engineering major who was randomly and equally assigned to the two instructional groups. Both of these two groups received six hours per week for nine weeks (54 hours) and a pretest was administered to the participants to measure their professional competence and trouble-shooting ability of interior wiring work. After the instruction completed, a practice of interior wiring work was given to evaluate students' overall performance and trouble-shooting ability as the posttest. The results indicated that leaner-centered instruction have a greater effect on students' overall performance (M=79.33) and trouble-shooting ability (M=72.89) of interior wiring work. These findings suggest that learner-centered instruction is helpful for vocational high school electrical engineering major students in interior wiring work both practice and trouble-shooting performance and they have positive correlation.

Keywords: Instructional Strategies, interior wiring, learning effectiveness, question mode teaching strategy.

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1. Introduction

The learner's learning outcome and the teacher's teaching activity arrangements are closely related, therefore, teaching strategies (Instructional Strategies), is the method used to promote the effectiveness of learning, and the key indicator of whether teaching models achieved learning effectiveness. Learning activities can be divided into two types, active and passive. The learner can self learn through exploration, or with knowledge provided by an instructor, and teaching strategies is the code that bridges these two extremes. Using the student's learning outcomes as the index is already the core thinking of the era of knowledge economy [1]. Focus on learning should have experience, background, talent and interest, through inspirational teaching methods to stimulate learning motivation to achieve the learning objectives and achievements. Hands on skills learning should be implemented appropriately, using the learner to guide teaching strategies, improve the student's learning attitude, and increase the student's learning effectiveness; and use classroom management skills to encourage effective small group cooperative learning activities. Based on the above, this article formulates the following research objectives: (1) explore the achievements of teaching strategies oriented on student learning in the "Interior Wiring Practice" subject; (2) investigate the affect of teaching strategies oriented on student learning have on the "Interior Wiring Practice" subject problem solving skill performance; 3) understand the students' view of teaching strategies in the "Interior Wiring Practice" subject.

2. Literary contribution discussion

2.1. The discussion of interior wiring is as follow.

Interior wiring is a residential power supply configuration skill, forming a safe and effective interior power source management through conduit wiring and control equipment. Recent technological development and building update, interior wiring and public safety became closely related to public safety, which affects building power supply's quality and efficiency [2]. Main area of work in interior wiring includes: (1) motor control circuits and control of electrical installation; (2) the installation of bus production, power transformer and high voltage fuses, isolating switches, and power distribution; (3) reduced oil circuit breakers, voltage transformers, and compensation capacitors or secondary wiring of lightning rod; (4) required switching operation and procedures for the correct operation of electrical equipment; (5) copying and reading of neutral point non-grounding system single ground fault handling meter copy, electric pole installation, cross arm assembly; (6) wire installation and cable construction. Therefore, interior wiring construction skills must go through rigorous training process in order to achieve the protection of building electricity safety [3], reduce electric leakage, electric shock disaster, etc., and to insure safety measures of people and property.

2.2. The discussion of teaching strategy orientation is as follow.

Teaching is an open format system with the external environment inputting messages and information, and the output is the learner. System concept is shown as in Fig 1. [4]. Learner-oriented teaching (learner-centered) has become a hot educational topic in recent years. Some scholars even pointed out that in education reform, teacher-oriented teaching approach must be changed to a learner-oriented teaching. Using learner oriented concept refers to the main emphasis being given to individual learners and their learning, with learning and testing matching each other [5], including their experience, background, talent and interest. Through this kind of teaching methods, individual learning motivation can be motivated to achieve personal learning goals and academic achievement.

The so-called learner-oriented teaching methods refers to teachers focusing on paying attention to student's problems and student's feelings [6], rather than the teacher's personal feelings. The teacher's main task is to understand the students and not to judge the students. In the course of learning, the learners create their own meaning and interpretation from a base of existing understanding and belief. Teachers should understand the positive aspect of teaching comes from the power of the student's internal motivation to pursue things. When teaching, teachers must first create an evolving atmosphere of trust, to help students ignite and clarify the purpose of studying [7]. Instigated by students thirst for knowledge to achieve the goal of learning, teaching not only has to pay attention to the contents of the material, but also be concerned about the students' emotions and attitudes. Pay attention to the deeper feelings of the students at all times in order to respond and express your understanding of the students.

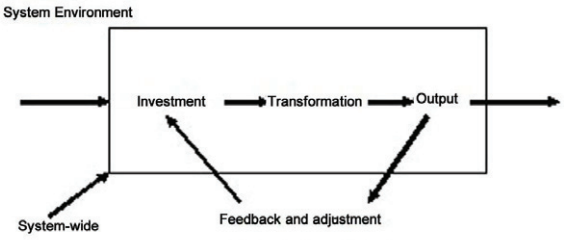

Fig. 1. Teaching System

2.3. The discussion of problem method teaching strategy is as follow.

Problem method teaching model is a problem-based learning model. It places learning and teaching in a complex, meaningful teaching strategy [8]. Problem method teaching model has three major basic elements: the problem scenario, students, and teachers. Teacher: Is a guide, an example for the students, think of and raise questions; monitor learning; encourage and inspire students to think; allow the student's continuous participation; monitor and adjust the difficulty level of the challenges; adjust the motivation of the small groups; and allow the learning to proceed. The students: as a proactive problem-solving and active participation; input type learning, active meaningful construction. Question: as the initial challenge and motivation for students, the structure is not fixed; must be attractive, motivated to solve the problem, coordination motivation; follow-up after being established according to learning needs.

3. Research methods

3.1. The experimental design and research structure are as follow.

Assume that to effectively achieve the research objectives and tests study, the experimental group of 18 people will adopt the learner-oriented teaching strategy. The control group of 18 people will use the traditional teaching strategy. The experimental group subjects in "Interior Wiring Practice" will proceed with 9 weeks and a total of 54 hours of experimental teaching. Experiment design model is shown in Table 1.

Table 1. Group division table of experimental teaching

Groups	Pre-test	Experimental treatment	Post-test

Experimental group	Y_1	X	Y_2
Control group.	Y_3	—	Y_4

Y_1,Y_3：indicate Pre-test；Y_2,Y_4：indicate post-test；X：Indicate gone through experimental treatment

Based on the research purpose and learner-oriented teaching strategy theory as a basis for exploration, and taking into account the actual problems of domestic students, this paper presents the theoretical framework of this study, shown in Fig 2. (1) Independent variables. Using standard experimental approach to divide the student sample into experimental group and control group to conduct teaching. For the "control group", traditional lecture teaching method is implemented. Implementation process includes lecture learning unit, basic skill operation, and actual work, using traditional evaluation methods for student achievement assessment. In the “experimental group”, in addition to using the traditional lecture method and teaching described in the control group, learner-oriented teaching strategy for teaching is also used as assessment for student learning achievement. (2) Controlled variables. This study’s controlled variables included the following three parts: “Students' basic professional ability" part refers to professional electrical mechanical subject “Interior Wiring Practice”, of three classes each week. This is controlled by using students’ “Interior Wiring Practice “grade total analysis method. The "teacher’s teaching ability" refers to the teacher ability in taking on the subject of “Interior Wiring Practice", including professional skills and teaching experience, and is to be controlled by the experimental process. (3) Dependent variable. The "Learner Oriented Teaching Strategy Learning Achievement” scale includes subject tests and technical tests. And the "Problem-Solving Ability Learning Achievements” scale’s five aspects include the ability to identify problems, data collecting capacity, the ability to select solutions, performing solutions, and the effectiveness of the solution.

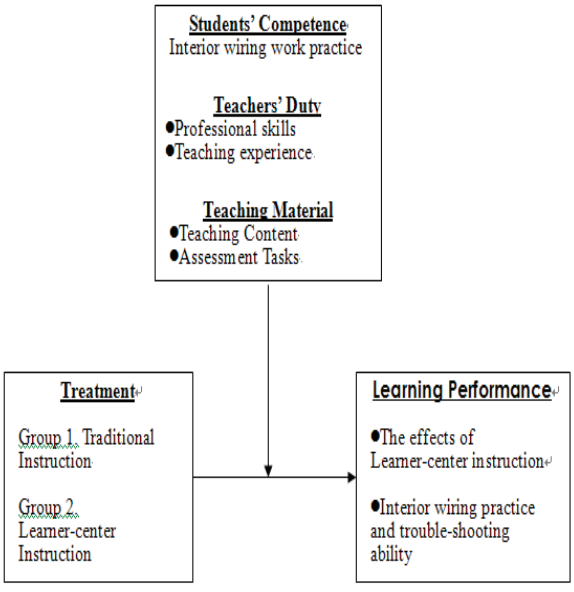

Fig. 2. Research organization chart

3.2. The research steps and tools are as follow.

Based on enabling students to be familiar with the application of various wiring circuits, this document especially conducted experiment design using “Manual, Automatic Level Control Circuit” as shown in Fig 3.

The steps are described as below: Lamp shunt is a single-phase two-wire 110 Volt, with a rated current of 15 Amp. Its function is two three-way switch (with fluorescent light showing) device controlling an incandescent lamp. The incandescent lamp is controlled from the second switch. When the incandescent light is on, the fluorescent lights of each switch will turn off. When the incandescent light is off, each switch's fluorescent indicator light will turn on, indicating each switch's position. The tools used in this research includes the following six types: learner-oriented teaching strategy course material, basic professional ability analysis, "Interior Wiring Practice" learner oriented teaching strategy learning achievement academic knowledge scale, "Interior Wiring Practice" learner oriented strategy learner's achievement technical skill scale, problem solving ability scale, and post learner-oriented teaching strategy learner questionnaire. This study's study flow chart is shown as in Fig 4.

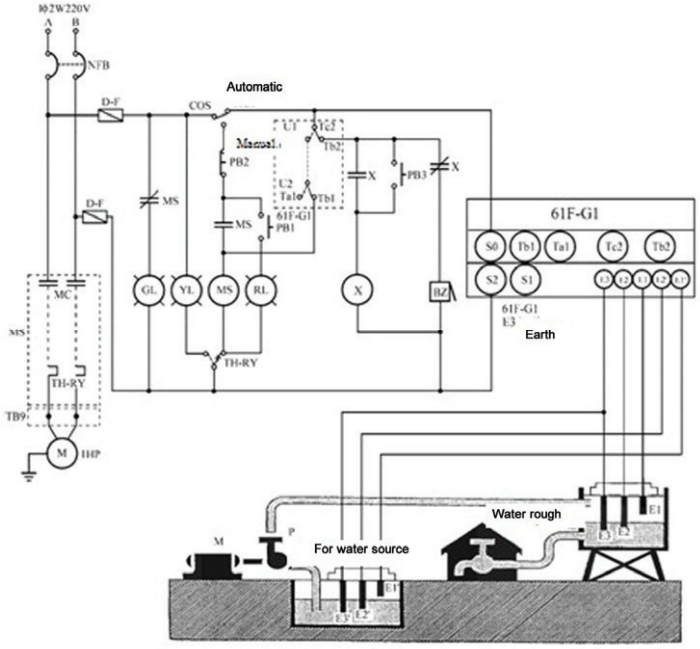

Fig. 3. Manual, automatic level control circuit

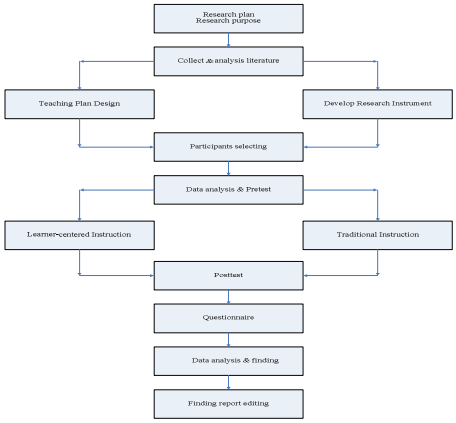

Fig. 4. Research flow chart

4. Study results.

4.1. The analysis of difference in student's academic learning and achievements for different groups of teaching strategies is as follow.

Table 2. shows the descriptive data of basic professional ability (pre-test) scale for each group of students. The data show that t = .39, p = .96, not reaching significant level. The second group of students' "Interior Wiring Practice" basic background ability did not show significant difference.

Table 2. Basic professional ability (pre-test) t test analysis summary

Group Difference	Number of people	Mean	Standard deviation	t values
Control group	18	79.28	6.20	.39
Experimental group	18	78.50	5.79	

*p<.05

4.2. The differential analysis of student problem solving skills ability for the implementation of different teaching strategies is as follow.

(1) Table 3. Results ANCOVA analysis result F = 1.09, p = .30 we can see after eliminating "Basic Professional Ability's (pre-test score) Affects" covariance, the two kinds of teaching method has not reached significant differences in the student's academic skill learning achievements. (2) The results of covariance analysis from Table 4. F = 9.92, p = .003 we can see after eliminating "The Affect of Basic Professional Ability (pre-test)" covariance, the student's technical skills achievement for the two types of teaching methods (technical skills Post-test) has reached a significant difference. Table 5. Results showed that after eliminating "Basic Professional Ability (pre-test score) Affect" covariance, the student's technical skills learning achievement (technical skills Post-test) performance, using learner-oriented teaching strategy (adjusted average of 80.35) was significantly better than traditional teaching methods (adjusted average of 76.00). (3) Table 6. Covariance analysis results show that F=7.52, p= .01, and after eliminating the "Basic Professional Ability (pre-test score) Affects" covariance, the student's overall academic and technical learning achievements (academic and technical subjects) has shown significant differences for the two different teaching methods. Table 7. Results shows that after eliminating the "Basic Professional Ability (pre-test score) Affects" covariance, the two types of teaching method's performance on the student's academic and technical overall learning achievement (academic and technical subject) result indicate learner-oriented teaching strategy (adjusted means of 79.33) was significantly better than the traditional teaching method (adjusted means of 75.83).

Table 3. Summary of academic post-test covariance analysis for the two types of teaching methods

Variation Source	SS	DF	MS	F
Between Group（Group Difference）	18.68	1	18.68	1.09
Within Group（Margin of Error）	566.07	33	17.18	

Table 4. Summary of technical skills Post-test covariance analysis for the two types of teaching methods

Variation Source	SS	DF	MS	F
Between Group（Group Difference）	169.60	1	169.60	9.92*
Within Group（Margin of Error）	564.10	33	17.09	

*p<.05

Table 5. The technical skill Post-test means, standard deviation, and means after adjustment of the two teaching methods

Group Difference	Number of people	Mean	Standard deviation	Means after adjustment
Control group.	18	75.68	6.28	76.00
Experimental group	18	80.67	6.49	80.35

Table 6. Summary of the academic and technical overall Post-test covariance analysis for the two teaching methods

Variation Source	SS	DF	MS	F
Between Group（Group Difference）	109.54	1	109.54	7.52*
Within Group（Margin of Error）	480.94	33	14.57	

*p<.05

Table 7. The academic and technical overall Post-test means, standard deviation, and adjusted means for the two teaching methods

Group Difference	Number of people	Mean	Standard deviation	Means after adjustment
Control group.	18	75.53	6.20	75.83
Experimental group	18	79.63	5.83	79.33

4.3. The students' problem-solving ability and "Interior Wiring Practice" learning achievement correlation analysis is as follow.

(1) Problem-solving skills Pre-test differential analysis. Table 8. shows that: The descriptive data of the two student group's problem solving skills pre-test scale indicates that t = .18, p = .85, which does not reach significant levels. The two groups of students then received problem solving ability test, of the means which does not reach significant level. In other words, the two groups of students' problem solving skills do not show a significant difference before the experiment. (2) Table 9. ANCOVA analysis result F = 7.94, p = .00, after eliminating the "Problem Solving Skill Pre-test Score's Affect" covariant, student's problem solving skills post-test shows significant difference for the two different methods of teaching. Table 10. Results show that after eliminating "Problem Solving Skill (pre-test score) Affects" covariance, the student's problem solving skill performance test (post-test) show that learner oriented teaching method (adjusted means 72.89) was significantly better than traditional teaching methods (adjusted means of 69.78).

Table 8. Summary of pre-test problem solving skills t-test analysis

Group Difference	Number of people	Mean	Standard deviation	t
Control group.	18	71.22	8.32	.18
Experimental group	18	70.72	7.94	

*p<.05

Table 9. Summary of the problem solving skill post-test covariant score analysis of the two methods of teaching

Variation Source	SS	DF	MS	F
Between Group（Group Difference）	86.90	1	86.90	7.94*
Within Group（Margin of Error）	361.05	33	10.94	

*p<.05

Table 10. The means, standard deviation, means after adjustment of the two teaching method's problem solving skills test.

Group Difference	Number of people	Mean	Standard deviation	Means after adjustment

Control group.	18	69.61	5.50	69.78
Experimental group	18	73.05	7.11	72.89

4.4. The results and discussion are as follow.

Using the Pearson product moment correlation analysis on the student experiment groups' problem solving ability post-test and higher vocational electrical mechanical students "Interior Wiring Practice" learning achievement (academic post-test, technical post-test, academic and technical overall post-test) to understand the relationship between the 5 levels of problem solving ability, academic learning achievements, technical skill practical achievement, and the academic and technical overall learning achievement. (1) Correlation analysis of problem-solving ability and academic achievement can be seen from Table 11. Analysis results: In problem-solving ability, other than problem confirmation level (r = .31) and academic learning achievements not reaching significant level, others such as data collection level (r = .51), select the solution levels (r = .46), implementation level (r = .41), solution effectiveness level (r = .72), as well as the overall capacity of performance (r = .56), reached significant level. (2) Correlation analysis of problem skills and technical learning achievements. Table 12. analysis results show that: all problem solving items, including problem confirmation (r = .60), data collection (r = .62), solution selection (r = .58), implementation (r = .54), solution effectiveness (r = .71), and overall performance ability (r = .69) and technical learning achievements correlation reached a significant level. (3) Correlation analysis between problem solving ability and overall learning achievement in Table 13. analysis result shows that: All items in problem solving, including problem confirmation (r = .53), data collection (r = .60), solution selection (r = .56), implementation (r = .50), solution effectiveness (r = .73), and overall performance ability (r = .66) have reached a significant level with academic and technical overall learning achievement.

Table 11. Summary of correlation analysis between problem solving skills and academic learning achievements

Project name	Problem Confirmation	Data Collection	Solution Selection	Execution	Solution Effectiveness	Overall Ability Performance
Academic Learning Achievement	.31	.51*	.46*	.41*	.72*	.56*

N=36；*p<.05

Table 12. Summary of correlation analysis between problem solving skills and technical learning achievements

Project name	Problem Confirmation	Data Collection	Solution Selection	Execution	Solution Effectiveness	Overall Ability Performance
Technical Learning Achievement	.60*	.62*	.58*	.54*	.71*	.69*

N=36；*p<.05

Table 13. Summary of correlation analysis between problem solving skills and academic and technical overall learning achievement

Project name	Problem Confirmation	Data Collection	Solution Selection	Execution	Solution Effectiveness	Overall Ability Performance
Learning Achievement	.53*	.60*	.56*	.50*	.73*	.66*

N=36；*p<.05

This article's actual equipment picture is shown as in below Fig 5; after the teaching experiment, all information results after statistical analysis is described as follows: In the student academic learning

achievement of “Interior Wiring Practice” the experimental group and the control group showed no significant differences. However, in overall technical learning achievement, the experiment group was superior to the control group. Secondly, for student problem solving learning achievement in “Interior Wiring Practice”, the experimental group was superior to the control group, and has correlation with “Interior Wiring Practice” learning achievements. Experimental group students had a significant positive view towards learner-oriented teaching strategy in post experiment investigation.

Fig. 5. Actual interior wiring picture

5. Conclusions.

This paper mainly discusses affects of learner oriented teaching strategy have on student learning achievements in “Interior Wiring Practice.” Through research questions, study implementation, and results of statistical analysis, conclusions are summarized as follows. (1) In adopt learner-oriented teaching strategy in “Interior Wiring Practice”, the overall learning achievement is superior than traditional teaching method. (2) In adopting learner-oriented teaching strategy, problem solving ability performance is superior to traditional teaching methods. (3) Implementing learner-oriented teaching strategy, students’ problem-solving skills and “Interior Wiring Practice” learning achievement has a positive correlation. According to the above conclusions, we can see that learner oriented teaching strategy is worthy of promotion in education, and can build a learner oriented learning environment through school administration and related resources. Teachers in relevant subject should utilize more learner-oriented teaching strategy while teaching to raise the students’ learning achievements and problem solving ability. And through organization of on-the-job teacher’s training, strengthen teacher’s use of learner oriented teaching strategy and improve teaching quality.

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